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Phytoplankton from Lake Boraphet in the Central Plain of Thailand

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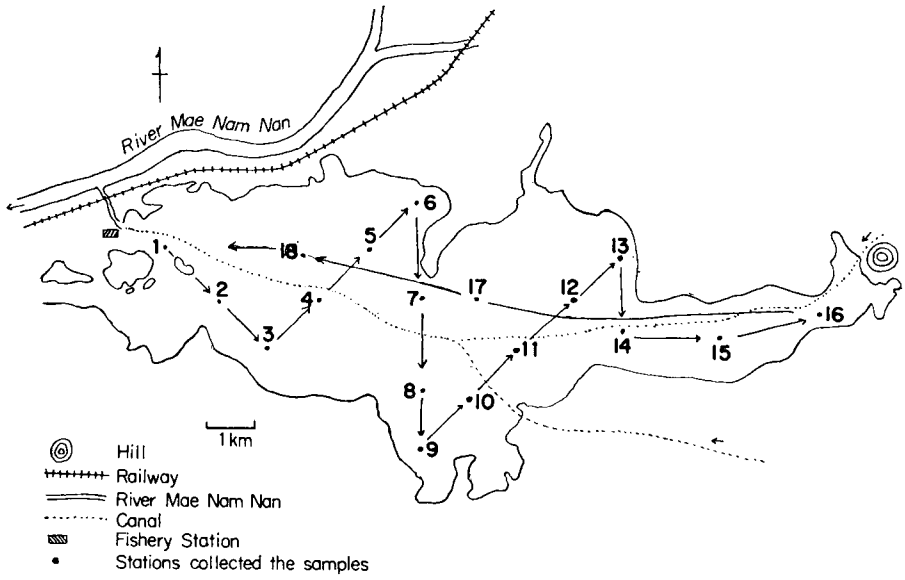
Dr. Osamu OKAMURA, a former member of "The Second Scientific Expedition by the Investigation Society of the Mekong Water System in Kôchi University, 1971–1972", has entrusted the author with his collection of the samples of plankton taken from Lake Boraphet in the central plain of Thailand. These samples were collected at the 17 stations in the lake during January 5 to 7, 1972. Most of the samples were taken from the surface water of the lake by the horizontal drawing method with a plankton net. In some stations the vertical drawing method was employed as well. A small collection of the samples of plankton was also made by the author when he visited the place on September 21, 1971, as a former member of "The Kyoto University Biological Expedition to Thailand, 1971". The result of the examination of these two samples will be described in the present paper. It is emphasized that the species recorded here may show the winter phytoplankton flora of Lake Boraphet because the summer collection was very limited.

Lake Boraphet (Bung Boraphet) is a flooding-lake situated near the confluence of the two rivers, the Mae Nam Pin River and the Mae Nam Nan River (the tributaries of the Menam River) (ca. Lat. 16°N. and Long. 100°E.). The boundary of the lake is changeable in the dry and rainy seasons, but the main part of the lake may cover the area of about 60,000 acres. The swampy zone with aquatic weeds in clusters is around the lake. The water level of the lake is controlled artificially at the western shore where the Fishery Station is located, so that the two slow currents of water from east to west are seen in the lake. According to the report of MIZUNO and MORI (1969 in Memoirs of the Ôsaka University of the Liberal Arts and Education, Vol. 18, Sect. 3), the deepest point of the lake may attain about 5 meters in depth; a great part of the lake is very shallow and attains about less than 1 meter in general. The water is muddy and pale yellow brown in color. The transparency is usually less than 1 meter. A large community of a water hyacinth (*Eichhornia crassipes*) is found on the surface of the lake near the Fishery Station on the west shore.

The winter collection examined contains an enormous number of the specimens of *Dinobryon sertularia*. A considerable number of the desmid species and several species of the Euglenaceae and of the chlorococcacean algae are also found. The planktonic diatom is rather rare. So-called water bloom or the cyanophycean algae (*Microcystis* and *Anabaena*) is absent in the samples. The above-mentioned winter phytoplankton flora of Lake Boraphet is quite different from that of Lake Tonle Sap in Cambodia reported in the previous papers (HIRANO, 1972 and 1973, in Contr. Biol. Lab. Kyoto Univ., 24 and 25). The blue-green algae (*Microcystis* and *Anabaena*),



green algae (*Pediastrum*) and some diatom species (*Melosira* and *Surirella*) were the main component of the latter lake.

It is an interesting fact that there is a noticeable difference of the phytoplankton flora of the Lake Boraphet between the seasons in winter and in summer. Although the author's collection of the summer samples taken from near the center of the lake was very limited, the phytoplankton consists of only cyanophycean algae (*Microcystis*) and some other algae such as *Dinobryon*. The specimens of these algae species are very few in number. No green algae and diatom species are found. On the contrary, the zooplankton (chiefly consisting of Copepoda species) is common in the summer samples.

The artificial control of the water level in Lake Boraphet seems to be one of the causes that affect the seasonal change of the plankton components of the lake.

CYANOPHYTA

Microcystis aeruginosa KG. in SMITH, Wisc. Geol. Nat. Hist. Surv. Bull. **57**, p. 39, pl. 5, f. 2,3, 1920; GEITLER, Krypt. Fl. **14**, p. 137, f. 59d, 1932.

Cell 5 μ in diameter. Hab. In the center of the lake. Collected in summer.

Oscillatoria borneti ZUKAL in GEITLER, l.c. p. 956, f. 585, 609, 1932.

Trichome 12–13 μ in diameter, not constricted at the cross wall. Hab. 2–3, 5–2, 8–1, 9.

Oscillatoria chalybea MERTENS in GEITLER, l.c. p. 956, f. 608b, 1932.

Trichome straight, slightly constricted at the cross wall, 10 μ in diameter; cell slightly broader than long. Hab. 8–1.

Oscillatoria lacustris (KLEB.) GEITLER in l.c. p. 955, f. 608c,d, 1932.

Trichome distinctly constricted at the cross wall, not attenuated to the end, 9 μ in diameter. Hab. 2–3.

Oscillatoria limosa AG. in GEITLER, l.c. p. 944, f. 598d, 1932.

Trichome 13–17.5 μ in diameter, not constricted at the cross wall but slightly constricted near the end. Hab. 17.

Oscillatoria terebriformis AG. in GEITLER, l.c. p. 954, f. 607d, 1932.

Trichome somewhat attenuated and spirally curved to the end, 6.5 μ in diameter. Hab. 9.

Phormidium tenue (MENEGH.) GOM. in GEITLER, l.c. p. 1004, f. 642d,e, 1932.

Trichome constricted at the cross wall, 2 μ in diameter; cell 2–2.5 times longer than broad, cell content homogeneous. Hab. 5–2.

Lyngbya aestuarii LIEBM. in GEITLER, l.c. p. 1052, f. 666, 1932.

Trichome 16–17 μ in diameter without sheath, not constricted at the cross wall; cell short, 1/7 times longer than broad. Hab. 1.

Lyngbya limnetica LEMM. in GEITLER, l.c. p. 1046, f. 661a,b, 1932.

Trichome straight, 2–2.5 μ in diameter, not constricted at the cross wall; cell about as long as broad. Hab. 5–2. Also collected in summer.

Lyngbya putealis MONT. in GEITLER, l.c. p. 1063, f. 675, 1932.

Trichome slightly constricted at the cross wall, 9 μ in diameter; cell slightly broader than long, contains granules. Hab. In the center of the lake. Collected in summer.

EUGLENOPHYTA

Euglena acus EHRENB. in GODJICS, Euglena p. 99, pl. 11, f.l, 1953; HUBER-PESTALOZZI, Binnengew. **16**: 4, p. 96, f. 75, 1955.

Cell 150 μ long, 12 μ broad. Contains several paramylon rod-shaped. Hab. 9,13.

Euglena charkoviensis SWIR. in HUBER-PESTALOZZI, l.c. p. 61, f. 37, 1955.

Cell large, anterior end broadly rounded, and posterior end becoming a fairly long tail, 115–141 μ long without tail, 145–163 μ long with tail, 13–20 μ broad, paramylon rod-shaped. Hab. 1, 13, 17. pl. 7, f. 7.

Euglena proxima DANG. in GOJDICS, Euglena p. 90, pl. 7, f. 7, 1953; HUBER-PESTALOZZI, l.c. p. 86, f. 64, 1955.

Cell 66–92 μ long, 22–30 μ broad. Hab. 9, 13, 15, 17. pl. 7, f. 4.

Phacus acuminatus STOKES var. ***discifera*** (POCHM.) HUBER-PESTALOZZI, l.c. p. 193, pl. 38, f. 225, 1955.

Cell ovate with short caudus, 26.5 μ long, 22 μ broad, contains two paramylon. Hab. 5–2.

Phacus helikoides POCHM. in Arch. Protistenk. **95**, p. 212, f. 124, 125, 1942; HUBER-PESTALOZZI, l.c. p. 226, pl. 51, f. 312, 1955.

Cell strongly twisted, 88 μ long without tail, 114 μ long with tail, 53 μ broad. Hab. 13.

Phacus longicauda (EHRENB.) DUJ. in HUBER-PESTALOZZI, l.c. p. 220, pl. 49, f. 299, 1955.

Cell like fig fruit, posterior part becomes a long straight caudus and its length equal to the length of a cell body, paramylon-body 2 and variable in size. Cell 52–88 μ long without caudus and 38–59 μ broad. Hab. 8–1, 9, 13. Pl. 7, f. 3.

Phacus orbicularis HÜBNER in POCHMANN, Arch. Protistenk. **95**, p. 178, f. 78a-p, 79a,b, 1942; HUBER-PESTALOZZI, l.c. p. 209, pl. 44, f. 273, 1955.

Cell 97 μ long without caudus and 80 μ broad, contains a large and a small paramylon. The present specimens are larger in size than those of the descriptions in the above referred literatures. Hab. 9,17.

Phacus ranula POCHM. in Arch. Protistenk. **95**, p. 212, f. 126, 1942; HUBER-PESTALOZZI, l.c. p. 227, pl. 52, f. 313, 1955.

Cell long elliptic, caudus fairly long but not beyond the length of a cell body, caudus curved and acute, cell without caudus 72–83 μ long, 40–44 μ broad. Hab. 2–3, 5–2, 7–3, 9. 17. Pl. 7, f. 6.

Phacus triqueter (EHRENB.) DUJ. in POCHMANN, l.c. p. 188, f. 92, 1942; HUBER-PESTALOZZI, l.c. p. 213, pl. 46, f. 284, 1955.

Cell ovate, 35 μ long without caudus and 44 μ long with caudus, 28.5 μ broad. Hab. 8–1.

Trachelomonas armata (EHRENB.) STEIN var. ***steinii*** DEFL. in HUBER-PESTALOZZI, l.c. p. 309, pl. 67, f. 585, 1955.

Cell ovate, furnished with a number of long robust and slightly curved spines at the posterior part and with a number of minute spines at the anterior part. Cell 39–40 μ long without spine and 31 μ broad. Hab. 9,13,15.

Trachelomonas hispida (PERTY) STEIN var. ***duplex*** DEFL. in HUBER-PESTALOZZI, l.c. p. 295, pl. 63, f. 522, 1955.

Cell furnished with denticulations on both ends, other part of the body densely punctate, 30 μ long, 22 μ broad. The present specimens resemble *Trachelomonas raciborskii* but differ from it in the smaller size of cell and the spines on both ends which are smaller and shorter than those of that species. The present specimens also resemble *Trachelomonas kellogii* reported from the Lake Tonle Sap although it is larger in size, compared with that species. Hab. 9. Pl. 4, f. 9.

Trachelomonas pulcherrima PLAYFAIR in HUBER-PESTALOZZI, l.c. p. 289, pl. 62, f. 497, 1955.

Posterior end of cell somewhat acute and rounded, cell wall smooth. The present specimens coincide with the form reported by SKVORTZOW from Australia as *Trachelomonas regulare* var. *glabra*. Hab. 13. Pl. 4, f. 8.

Trachelomonas superba DEFL. in HUBER-PESTALOZZI, l.c. p. 306, pl. 66, f. 569, 1955.

Cell elliptic, covered with a number of spines which are fairly long and stout, 43 μ long without spine and 40 μ broad without spine. Hab. 15. Pl. 4, f. 7.

CHRYSOPHYTA

Botryococcus braunii KG. in SMITH, l.c. p. 84, pl. 15, f. 5, 1920.

Rarely found in the summer plankton-samples. Hab. In the center of the lake.

Centrotractus belonophorus (SCHMIDLE) LEMM. in Süssw.-fl. **11**, p. 53, f. 35, 1925; HUBER-PESTALOZZI, Binnengew. **16**: 2–1, p. 323, f. 404, 1941.

Cell without spine 31–88 μ long, 6–6.5 μ broad. Hab. 9, 11–3. Pl. 4, f. 12.

Dinobryon sertularia EHRENB. in SMITH, l.c. p. 74, pl. 13, f. 13, 1920.

Hab. Abundant in all samples. Collected in winter.

Ophiocytium capitatum WOLLE in SMITH, l.c. p. 86, pl. 15, f. 12–13, 1920.

Cell 4.5 μ broad, strongly curved, almost half-circular, with strong and fairly long spine on each pole. Hab. 5–2.

Ophiocytium cochleare BRAUN in PASCHER, Süssw.-fl. **11**, p. 77, f. 60, 1925.

Cell strongly curved, one end rounded and the other with a long spine. Hab. 5–2. Pl. 4, f. 11.

CHLOROPHYTA

Chlorophyceae

Actinastrum hantzschii LAGERH. var ***fluviatile*** SCHRÖDER in PRESCOTT, Algae Great Lake Area p. 282, pl. 65, f. 1, 1951.

Cell 22 μ long, 3.5 μ broad. Hab. 7–3. Pl. 4, f. 13.

Characium ensiforme HERMANN in BRUNTHALER, Süssw.-fl. **5**, p. 79, f. 22, 1915.

Cell lanceolate or narrow lunate, one side of the lateral margin almost straight, apex of cell acute. The species are attached to *Surirella* of diatom. Cell 17.5 μ long and 5.3 μ broad. Hab. 13.

Coelastrum cambricum ARCH. in SMITH, l.c. p. 161, pl. 42, f. 2–3, 1920; PHILIPOSE, Chlorophyceae p. 230, f. 138a, 1967.

Rare in sample No. 9.

Crucigenia tetrapedia (KIRCHN.) W. & G. S. WEST in SMITH, l.c. p. 147, pl. 37, f. 2, 1920; PHILIPOSE, l.c. p. 240, f. 151, 1967.
Rare. Hab. 8–1.

Eudorina elegans EHRENB. in SMITH, l.c. p. 96, pl. 19, f. l, 1920.
Rare in sample No. 15.

Nephrocytium lunatum W. WEST in PHILIPOSE, l.c. p. 189, f. 103, 1967.
Cell 17.5 μ long, 7.5 μ broad. Hab. 15. Pl. 4, f. 10.

Pediastrum biradiatum MEYEN var. ***longecornutum*** GUTW. in PHILIPOSE, l.c. p. 128, f. 44b–d, 1967.
Marginal cell with two projections with deep incision and each projection terminated at a divergent horn of unequal length, the inner horn longer than the outer one. Rare in plankton samples. Pl. 7, f. 8.

Pediastrum duplex MEYEN in SMITH, l.c. p. 171, pl. 46, f. 14–16, 1920; PHILIPOSE, l.c. p. 121, f. 43a,b, 1967.
Rare in sample No. 5–2.

Pediastrum duplex var. ***cohaerens*** BOHLIN in SMITH, l.c. p. 173. pl. 48, f. 3–4, 1920.
Hab. 5–2, 13. Pl. 4, f. 4.

Pediastrum duplex var. ***gracillimum*** W. & G. S. West in SMITH, l.c. p. 172, pl. 47, f. 8–11, Pl. 48, f. 1–2, 1920.
Common in winter plankton. Hab. 1, 2–3, 7–3, 15. Pl. 4, f. 3.

Pediastrum duplex var. ***subgranulatum*** RACIB. in PHILIPOSE, l.c. p. 125, f. 43c,j, 1967.
Hab. 9.

Pediastrum simplex MEYEN in SULEK, FOTT's Stud. Phycol. p. 210, pl. 1. 1967.
Rare. Hab. 17.

Quadrigula lacustris (CHODAT) SMITH in l.c. p. 139, pl. 33, f. 4–6, 1920.
Cell 24 μ long and 4.5 μ broad. Hab. 9.

Scenedesmus arcuatus LEMM. var. ***platydisca*** SMITH in l.c. p. 154, pl. 39, f. 1–3, 1920.
Hab. 8–1, 9.

Tetraedron regulare KG. in SMITH, l.c. p. 118, pl. 24, f. 14, 1920; PRESCOTT, l.c. p. 269, pl. 60, f. 24–26, 1951.
Cell tetragonal, side slightly concave, angles with a stout spine. Hab. 9, 15, 17. Pl. 4, f. 5. Pl. 7, f. 5.

Tetraedron trigonum (NÄG). HANSG. var. ***gracile*** (REINSCH) De TONI in

PRESCOTT, l.c. p. 270, pl. 61, f. 14–16, 1951.

Cell small, flat, triangular, angles with a narrow projection. Hab. 17. Pl. 7, f. 9.

Conjugatae

Netrium digitus (EHRENB.) ITZIGS. & ROTHE var. ***nagelii*** (BRÉB.) KRIEGER in Krypt. Fl. 13, Abt. 1, p. 218, pl. 8, f. 4,5, 1933.

Cell 98 μ long, and 28 μ broad. Hab. 15.

Gonatozygon aculeatum HASTING in HIRANO, Contr. Biol. Lab. Kyoto Univ. **1**, p. 23, pl. 1, f. 4, 1955.

Cell 163–233 μ long, 11–11.5 μ broad, spine fairly long and acute. Hab. 1, 5–2.

Gonatozygon monotaenium DeBARY in W. & G. S. WEST, Monogr. Brit. Desm. **1**, p. 30, pl. 1. f. 1–7, 1904; HIRANO, l.c. p. 22, pl. 1, f. 1, 1955.

Cell 128–220 μ long and 6–8 μ broad. Hab. 1, 5–2, 9, 13, 17. Pl. 7, f. 2.

Closterium acerosum (SCHRANK) EHRENB. in WEST, Monogr. Brit. Desm. **1**, p. 146, pl. 18, f. 2–5, 1904; KRIEGER, l.c. p. 314, pl. 23, f. 11, 12, 1935.

Cell 470–473 μ long and 30–31 μ broad. Hab. In the center of the lake. Collected in summer.

Closterium cornu EHRENB. in WEST, l.c. p. 157, pl. 20, f. 1–5, 1904; KRIEGER, l.c. p. 269, pl. 15, f. 5–9, 1935.

Cell 100–105 μ long and 6 μ broad. Hab. 1.

Closterium cornu var. ***javanicum*** GUTW. in KRIEGER, l.c. p. 270, pl. 15, f. 11, 1935.

Cell 118–121 μ long and 4.5 μ broad. Hab. 8–1.

Closterium kutzingii BRÉB. in KRIEGER, l.c. p. 351, pl. 32, f. 8,9, 1935.

Cell 308–448 μ long, 13–14 μ broad. Hab. 8–1.

Closterium johnsonii W. & G. S. WEST in KRIEGER, l.c. p. 309, pl. 23, f. 3, 1935.

Cell variable in length, sometimes elongate, sides not parallel, gradually attenuated toward the apex which is truncate and rounded. The present specimens are somewhat narrower than those of the American species reported by WEST. Hab. 5–2, 13.

Closterium parvulum NÄG. in KRIEGER, l.c. p. 275, pl. 16, f. 14–17, 1935.

Cell 74–78 μ long and 9–10 μ broad. Hab. 9.

Closterium parvulum var. ***angustum*** W. & G. S. WEST in KRIEGER, l.c. p. 277, pl. 16, f. 20,21, 1935.

Cell 77–79 μ long and 6 μ broad. Hab. In the center of the lake. Found in summer collection.

Closterium pygmaeum GUTW. in KRIEGER, l.c. p. 278, pl. 16, f. 13, 1935.

Cell minute, slightly curved, not tumid in the middle, gradually attenuated toward the apex which is rounded; cell wall smooth, cell contains two pyrenoids in half part of cell. Cell 57 μ long and 5.3 μ broad. Hab. 1.

Closterium sinense LÜTKEM.

var. **minus** HIRANO, var. nov.

Cellulae minores, 44 μ longae, 6 μ latae, apicibus late rotundatis, membrana glabra. Hab. 9. Pl. 1, f. 2.

Closterium venus KÜTZ. in KRIEGER, l.c. p. 272, pl. 16, f. 1–5, 1935.

Cell 27–31 μ long and 6–8 μ broad. Hab. 7–3, 8–1.

Pleurotaenium ehrenbergii (BRÉB.) deBARY in KRIEGER, l.c. p. 410, pl. 42, f. 4–8, 1937.

Cell 286–502 μ long, 13–21 μ broad, apex 11–14 μ braod. Hab. 5–2, 9.

Pleurotaenium ehrenbergii var. ***elongatum*** (W. WEST) W. & G. S. WEST in KRIEGER, l.c. p. 414, pl. 43, f. 1, 1937.

Cell 383–414 μ long, 17.5–21 μ broad, and apex 9–13 μ broad. Hab. 5–2. 7–3.

Pleurotaenium trabecula (EHRENB.) NÄG. var. ***rectum*** (DELP.) W. & G. S. WEST in KRIEGER, l.c. p. 402, pl. 41, f. 2, 1937.

Cell 405–410 μ long, 21 μ broad. Hab. 1.

Pleurotaenium verrucosum (BAIL.) LUND. in KRIEGER, l.c. p. 438, pl. 51, f. 3, 1937.

Cell 387–394 μ long, 30–31 μ broad, and apex 17.5 μ broad. Hab. 15.

Cosmarium alpestre ROY & BISSET in TAYLOR, Pap. Mich. Acad. Sci. Art & Lett. **19**, p. 250, pl. 49, f. 5, 1934; PRESCOTT & SCOTT. Trans. Amer. Micr. Soc. **61**, p. 12, pl. 2, f. 6, 1942.

Cell 77 μ long and 71 μ broad. Hab. 13. Pl. 2, f. 13.

Cosmarium blyttii WILLE in WEST, Monogr. **3**, p. 225, pl. 86, f. 1–4, 1908.

Cell 17–18 μ long, 13 μ broad and isthmus 3.5 μ broad. Hab. 13.

Cosmarium blyttii forma ***australicum*** SCHMIDLE in SCOTT & PRESCOTT, Hydrobiol. **17**, p. 55, pl. 31, f. 15, 1961.

Cell 15 μ long, 15 μ broad, and isthmus 2.5 μ braod. Hab. 15.

Cosmarium contractum KIRCHN. in WEST, Monogr. **2**, p. 170, pl. 61, f. 23–25, 1905.

Cell 26.5–44 μ long, 18.5–35 μ broad, and isthmus 4.5–6.5 μ broad. Hab. 2–3, 5–2, 8–1, 9, 13, 15. Pl. 5, f. 15.

Cosmarium contractum var. ***minutum*** (DELP.) W. & G. S. WEST in l.c. **2**, p. 173, pl. 61, f. 30, 31, 1905.

Cell 19–20 μ long, 17–18 μ broad, and isthmus 4.5 μ broad. Hab. 13.

Cosmarium cuneatum JOSHUA in Journ. Linn. Soc. Bot. **21**, p. 647, pl. 24, f. 17,19, 1886; SCOTT & PRESCOTT, Hydrobiol. **17**, p. 57, pl. 30, f. 3, 1961.

Cell hexagonal-circular, as long as broad, very deeply constricted at the middle, sinus acutely open; semicell somewhat trapeziform-semicircular, basal angle somewhat produced and acute, margin undulate-crenulate, apex almost straight, cell with a marginal series of granules within the margin, four fairly large granules just below the apex of the semicell. Cell 39 μ long, 39 μ broad, and isthmus 11 μ broad. Hab. 15. Pl. 1, f. 3.

Cosmarium depressum (NÄG.) Lund. in WEST, Monogr. Brit. Desm. **2**, p. 176, pl. 62, f. 2–5, 1905.

Cell 44–48 μ long, 40–42 μ broad, and isthmus 11–12 μ broad. Hab. 7–3, 17.

Cosmarium depressum forma ***minuta*** HEIMERL in KRIEGER, Arch. Hydrobiol. Suppl. **11**, p. 175, pl. 9, f. 18, 1932.

Cell 17.5 μ long, 20 μ broad, and isthmus 5.7 μ broad. Hab. 9.

Cosmarium depressum var. ***achondrum*** (BOLDT) W. & G. S. WEST in l.c. **2**, p. 177, pl. 62, f. 6–9, 1905.

Cell 44 μ long, 39.5 μ broad, and isthmus 11 μ broad. Hab. 1, 8–1.

Cosmarium geminatum LUND. in WEST, l.c. **3**, p. 177, pl. 81, f. 15, 1908.

Cell 26.5 μ long, 22 μ broad, and isthmus 6.5 μ broad. Hab. 9.

Cosmarium globosum BULNH. in WEST, l.c. **3**, p. 29, pl. 68, f. 1, 2, 1908.

Cell 30–31 μ long, 19.5–20 μ broad, and isthmus 17.5–18 μ broad. Hab. 8–1.

Cosmarium impressulum ELFV. var. ***johorense*** BERNARD in Dept. Agr. Indes. Neerl. p. 44, pl. 3, f. 66, 67, 1909.

Cell 20–24 μ long, 13–17 μ broad, and isthmus 4–5 μ broad. Hab. 9. Pl. 5, f. 16.

Cosmarium inconspicuum W. & G. S. WEST in l.c. **2**, p. 164, pl. 61, f. 1, 2, 1905; KRIEGER, Arch. Hydrobiol. Suppl. **11**, p. 178, pl. 8, f. 18, 1932.

Cell 12 μ long, 12 μ broad, and isthmus 3.5 μ broad. The present specimens resemble the English form in its description and figures but are somewhat different in narrower isthmus and deeper sinus. The species is characteristic of a rounded sinus at the extremity. The outline of the form of semicell and the opening of sinus is similar to that of the *C. contractum*, but the size of the cell is markedly smaller. Hab. 9.

Cosmarium lundellii DELP. var ***crassangulatum*** SCOTT & PRESCOTT in Hydrobiol. **17**, p. 61, pl. 25, f. 10, 1961.

Cell 66 μ long, 66 μ broad, and isthmus 28 μ broad. Hab. 13. Pl. 2, f. 12.

Cosmarium maculatiforme SCHMIDLE var. ***maior*** GUTW. in SKUJA, Nov. Act. Reg. Soc. Sci. Upsal. ser. 4, **14**: 5, p. 126, pl. 27, f. 18, 1949.

Cell 119 μ long, 62 μ broad, and isthmus 40 μ broad. Hab. In the center of the lake. Collected in summer collection.

Cosmarium moniliforme (TURP.) RALFS var. ***subpyriforme*** W. & G. S. WEST in Monogr. Brit. Desm. **3**, p. 23, pl. 67, f. 5, 1908.

Cell 38–41 μ long, 22–23 μ broad, and isthmus 6 μ broad. Hab. 8–1.

Cosmarium portianum ARCH. in WEST, l.c. **3**, p. 165, pl. 80, f. 4–7, 1908.

Cell 24 μ long, 20 μ broad, and isthmus 7.5 μ broad. Hab. 15.

Cosmarium pseudarctoum NORDST. in WEST, l.c. **3**, p. 32, pl. 68, f. 12–14, 1908; SCOTT & PRESCOTT, Hydrobiol. **17**, p. 66, pl. 32, f. 20, 1961.

Cell a little longer than broad, moderately retuse in the middle; semicell depressed ovate with slightly flattened and sometimes slightly retuse apex. Cell 10.5 μ long, 10.3 μ broad, and isthmus 10 μ broad. Hab. 9. Pl. 5, f. 17.

Cosmarium quadrifarium LUND. forma ***hexasticha*** (LUND.) NORDST. in WEST, l.c. **3**, p. 143, pl. 77, f. 4, 1908.

Cell 48–50 μ long, 39–40 μ broad, and isthmus 13 μ broad. Hab. 8–1.

Cosmarium quadrum LUND. in WEST, l.c. **4**, p. 20, pl. 100, f. 3–6, 1911.

Cell 79 μ long, 64 μ broad, and isthmus 20 μ broad. Hab. 5–2.

Cosmarium quadrum var. ***minus*** NORDST. in WEST, l.c. **4**, p. 21, 1911.

Cell 40.5 μ long, 42 μ broad, and isthmus 15.5 μ broad. Hab. 15.

Cosmarium subtriordinatum W. & G. S. WEST in Bot. Tidsskr. **24**, p. 173, pl. 2, f. 18, 1901.

Cell 20 μ long, 19 μ broad, and isthmus 7 μ broad. Hab. 5–2. Pl. 1, f. 10.

Cosmarium tijibenongense GUTW. forma ***minus*** G. S. WEST in SCOTT & PRESCOTT, Hydrobiol. **17**, p. 72, pl. 27, f. 8, 1961.

Semicell angularly depressed pyriform, apical angle well rounded, sinus obtuse and rounded at the extremity. Cell 39.5 μ long, 26.5 μ broad, and isthmus 6.5 μ broad. The present specimens are larger than those of the Sumatran forms given by SCOTT & PRESCOTT and also apical angles are somewhat different from those of the Sumatran forms in having a rounded angle instead of an angular one. KRIEGER reported the similar form from the southern Sumatra named *C. pseudoprotuberans* var. *angulatum*. The size of the form well coincides with that of the present specimens examined. Pl. 2, f. 4.

Cosmarium trachypleurum LUND. var ***nordstedtii*** GUTW. in KRIEGER, Arch. Hydrobiol. Suppl. **11**, p. 188, pl. 11, f. 11, 1932.

Cell 30 μ long, 23 μ broad, and isthmus 8 μ broad. Hab. 9. Pl. 2, f. 3; Pl. 5, f. 14.

Arthrodesmus convergens EHRENB. in WEST, l.c. **4**, p. 106, pl. 116, f. 4–13, 1911.

Cell 46 μ long, 44 μ broad without spine, and isthmus 10 μ broad. Hab. 15.

Arthrodesmus convergens var. ***curtus*** TURNER in K. Sv. Vet. Akad. Handl. **25**, p. 134, pl. 11, f. 32, 1892.

Cell deeply constricted and narrowly linear; semicell somewhat reniform, lateral spine variable in size, some specimens have a short, somewhat convergent spine in one semicell and have a papilla on each side or on one side in other semicells of the same specimens, and in some specimens a spine is quite destitute in one semicell and becomes a papilla in other semicell. GRÖNBLAD, SCOTT and CROASDALE reported the form showing the same manner as seen in Thailand specimens from Uganda, E. Africa. Cells 46–53 μ long, 44–48 μ broad without spine, and isthmus 11–13 μ broad. Hab. 1, 2–3, 5–2, 13. Pl. 1, f. 7; Pl. 6, f. 5.

Arthrodesmus curvatus TURNER in KRIEGER, Arch. Hydrobiol. Suppl. **11**, p. 191, pl. 13, f. 16, 1932.

Cells 31–44 μ long, 37.5–44 μ broad without spine, and isthmus 8–13 μ broad. The present specimens coincide with the form reported from the Sunda Islands. The species seems to be distributed widely from Southeast Asia to the east side of Africa. The semicells are variable in their form of cell and spine, and are called by a particular name as a variety in the various districts respectively. Some of the forms resemble *A. convergens* but are distinguished from those forms by the position of lateral spine. Hab. 5–2, 7–3, 8–1, 9, 13, 17. Pl. 2, f. 2; Pl. 5, f. 12.

Arthrodesmus curvatus var. ***kalimantanum*** SCOTT & PRESCOTT, Hydrobiol. **17**, p. 75, pl. 34, f. 1, 1961.

Cell 44–49 μ long, 46–52 μ broad without spine, and isthmus 10–13 μ broad. Hab. 1, 9, 15. Pl. 1, f. 4, 5.

Xanthidium burkillii W. & G. S. WEST in Annales Royal Bot. Gard. Calcutta **6**, p. 210, pl. 15, f. 10, 1907; SCOTT & PRESCOTT, Hydrobiol. **17**, p. 80, pl. 40, f. 1, 1961.

Cell 46 μ long without spine, 48 μ broad without spine, and isthmus 24 μ broad. Hab. 1, 8–1, 9, 15, 17.

Xanthidium hastiferum TURNER var. ***javanicum*** (NORDST.) TURNER in HIRANO, Contr Biol. Lab. Kyoto Univ. **23**, p. 143, pl. 8, f. 6, 1972.

Semicell with a pair of spine at the apical angle and single spine at the lateral angle, sinus acute and obtusely rounded at the extremity but in some specimens sinus sublinearly open. Cell without spine 40–48 μ long, 40–57 μ broad without spine, and isthmus 8–13 μ broad. Hab. 1, 8–1, 9, 15, 17. Pl. 1, f. 1; Pl. 6, f. 9.

Micrasterias foliacea BAIL. in SCOTT & PRESCOTT, Hydrobiol. **17**, p. 48, pl. 20, f. 4, 1961.

Cell 66 μ long, 70 μ broad, and isthmus 11 μ broad. Hab. 15. Pl. 7, f. 1.

Micrasterias radians TURNER in K. Sv. Vet. Akad, Handl. **25**, p. 19, pl. 5, f. 6, 1892; SCOTT & PRESCOTT, Hydrobiol. **17**, p. 51, pl. 23, f. 1, 1961.

Cell 123–140 μ long, 110–132 μ broad, and isthmus 13–17.5 μ broad. The

present specimens are somewhat different from the original figure given by TURNER in having a deeper interlobular incision. The figure given by SKUJA, KRIEGER, SCOTT & PRESCOTT seems to be the same species. The var. *bogoriensis* given by BERNARD as a separate species is also the same *M. radians* TURNER.

Micrasterias radians var. ***bogoriensis*** (BERNARD) G. S. WEST in SCOTT & PRESCOTT, Hydrobiol. **17**, p. 51, pl. 23, f. 2,3, 1961.

Cell 150 μ long, 132 μ broad, and isthmus 14.5 μ broad. Hab. 5–2.

Staurastrum acanthastrum W. & G. S. WEST in Trans. Linn. Soc. Bot. **6**, p. 183, pl. 22, f. 1, 1902; SCOTT & PRESCOTT, Hydrobiol. **17**, p. 85, pl. 42, f. 1, 1961; THOMASSON, Nova Hedw. **21**, p. 307, f. 11c–e, 1971.

Cell 30–32 μ long, 52–54 μ broad with processes, and isthmus 9 μ broad. The present specimens resemble *St. limneticum* var. *burmense* in the vertical view but the processes of the present specimens are not curved upward but are horizontal in the front view of semicell. THOMASSON reported the 4-angular form of this species from Lake Arthuro, Tasmania, but the specimens of Lake Boraphet are 5-angular and the processes are slender and long and 3 nodulated, tipped with sharp spines at the extremity like the Tasmanian form. Hab. 5–2, 9. Pl. 5, f. 10.

Staurastrum ambiguum TURNER in SKUJA, Nov. Act. Reg. Soc. Sci. Upsal. ser. IV, **14**: 5, p. 152, pl. 35, f. 2, 1949.

Cell 4-angular form, processes horizontal and 3 nodulated, basal part of semicell subrectangular, basal angle rounded, and sinus acuminated and fairly closed. Cell 21 μ long, 23 μ broad, and isthmus 4.5 μ broad. Hab. 8–1. Pl. 2, f. 9.

Staurastrum apiculatum BRÉB. in WEST & CARTER, Monogr, Brit. Desm. **5**, p. 6, pl. 129, f. 6–8, 1923.

Cell 21–22 μ long without spine, 22 μ broad without spine, and isthmus 4.5 μ broad. Hab. 5–2, 9.

Staurastrum cuspidatum BRÉB. in WEST & CARTER, l.c. p. 23, pl. 132, f. 13–15, 1923.

Cell 26–27 μ long, 22–22.5 μ broad without spine, and isthmus 6.5 μ broad. Hab. 7–3.

Staurastrum dejectum BRÉB. in WEST & CARTER, l.c. **5**, p. 7, pl. 129, f. 9–12, 1923.

Cell 26.5 μ long without spine, 24 μ broad without spine, and isthmus 12 μ broad. Hab. 15.

Staurastrum duacense W. & G. S. WEST in WEST & CARTER, l.c. **5**, p. 116, pl. 148, f. 1, 1923.

Cell 36.5 μ long, 66 μ broad including processes, and isthmus 9 μ broad. Hab. 5–2.

Staurastrum excavatum G. S. WEST in Trans. Linn. Soc. Bot. **5**, p. 78, pl. 8, f. 42, 1895; HIRANO, Contr. Biol. Lab. Kyoto Univ. **23**, p. 148, pl. 10, f. 1, 1972.

Cell 35 μ long including processes, 60–62 μ broad including processes, and isthmus 7.5 μ broad. Hab. 8–1, 9, 13. Pl. 3, f. 11; Pl. 5, f. 11.

Staurastrum gracile RALFS in WEST & CARTER, Monogr. **5**, p. 96, pl. 144, f. 4, 1923.

Cell about twice as long as broad or a little longer, sinus acuminate and widely open; semicell cup-shaped, apex slightly convex, processes horizontal, slender, 5-nodulated and tipped with 3 minute spines; semicell in vertical view triradiate, side concave, angle produced into a slender and long tapering process which is five nodulations on each side. Cell 26–27 μ long, 37–42 μ broad with processes, and isthmus 6 μ broad. The present specimens resemble well the figure given by WEST's monograph, pl. 144, f. 4. Hab. 7–3, 8–1.

Staurastrum gracile var. ***coronulatum*** BOLDT in FÖRSTER, Nova Hedw. **20**, p. 334, pl. 29, f. 4, 1970.

Semicell cup-shaped, apex slightly convex, processes moderately long and nearly horizontal, tipped with tiny spines at the extremity, processes 5 or 6 nodulated; semicells in vertical view triangular, side almost straight with a pair of verrucae within the margin. Cell 24–39 μ long with processes, 34–48 μ broad with processes, and isthmus 6.5–11 μ broad. The present specimens are distinguished from the *Staurastrum pingue* by the smaller size, the shorter process and the different shape of the lower part of semicell which is cup-shaped, not campanulate. This form and GRÖNBLAD's *St. manfeldtii* var. *parvum* from North America have an inflated lower part of semicell. The latter form is distinguished from *St. gracile* var. *coronulatum* by the shape of semicell but they coincide with each other in the dimension. Hab. 5–2, 7–3, 9, 15. Pl. 3, f. 6, 7; Pl. 5, f. 2, 3.

Staurastrum javanicum (NORDST.) TURNER var. ***apiculiferum*** (TURNER) KRIEGER in Arch. Hydrobiol. Suppl. **11**, p. 201, pl. 20, f. 3, 1932.

Cell 52–54 μ long, 83–85 μ broad including processes, and isthmus 14 μ broad. The writer has met with two different forms: one has a semicell decorated by a basal series of verrucae and the other lacks this series of verrucae. Processes of these specimens are robust and curved inward and provided with 4 denticulations at the extremity; semicell with apical series of 6 verrucae and these are seen well in the vertical view of semicell. Hab. 1, 8–1, 13. Pl. 3, f. 3, 4; Pl. 6, f. 6.

Staurastrum leptocladum NORDST. in SMITH, Wisc. Geol. Nat. Hist. Surv. Bull. **57**, p. 102, pl. 78, f. 1–7, 1924; HIRANO, Contr. Biol. Lab. Kyoto Univ. **23**, p. 149, pl. 10, f. 7, 1972.

Cell 41–45 μ long, 22–30 μ broad without processes, 92–97 μ broad with processes, and isthmus 5–6 μ broad. Hab. 5–2.

Staurastrum leptodermum LUND. var. ***ikapoae*** (SCHMIDLE) W. & G. S. WEST in Ann. Royal Bot. Gard. Calcutta **6**, p. 213, pl. 16, f. 8, 1907; HIRANO, Contr. Biol. Lab. Kyoto Univ. **23**, p. 149, pl. 6, f. 8, 1972.

Cells 35–42 μ long without spine, 35–44 μ broad without spine, and isthmus 13–15 μ broad. Hab. 1, 2–3, 5–2, 8–1, 9, 13, 15, 17. Pl. 2, f. 10, 11; Pl. 5, f. 1.

Staurastrum limneticum SCHMIDLE var. ***burmense*** W. & G. S. WEST in Annales Royal Bot. Gard. Calcatta **6**, p. 222, pl. 16, f. 13, 1907; SCOTT & PRESCOTT, Hydrobiol. **17**, p. 97, pl. 42, f. 2,3, 1961.

Cell 30–31 μ long without processes, 79 μ broad with processes, and isthmus 9 μ broad. Hab. 1, 2–3, 5–2, 7–3, 8–1, 17. Pl. 3, f. 1, 2.

Staurastrum longebrachiatum (BORGE) GUTW. in KRIEGER, Arch. Hydrobiol. Suppl. **11**, p. 202, pl. 16, f. 1, 1932.

Semicell with an obliquely turncated verruca on each side at the base just above the sinus, two other emarginate verrucae disposed on the lateral side just below the base of processes, the lower one of these two verrucae is distinct and large, while the other is variable in size and sometimes smaller than the lower one, processes very long and almost horizontal but sometimes inclined to curve upward or inward. Cell 35–44 μ long, 70–110 μ broad with processes, and isthmus 6.5–8 μ broad. Hab. 5–2, 9, 15, 17. Pl. 3, f. 5.

Staurastrum longebrachiatum var. ***pseudanchora*** KRIEGER in l.c. p. 202, pl. 16, f. 3, 1932.

Cell 34 μ long, 84 μ broad with processes, and isthmus 9 μ broad. Semicell with 4 distinct verrucae at the apex, processes long, slender and not curved inward, without a verruca just above the isthmus. Hab. 13. Pl. 6, f. 7.

Staurastrum megacanthum LUND. var. ***orientale*** SCOTT & PRESCOTT in Hydrobiol. **17**, p. 98, pl. 55, f. 5, 6, 1961.

Cell 26–27 μ long without spine, 26.5–27 μ broad without spine, and isthmus 7.5 μ broad. The present forms coincide with the description and figures given by SCOTT & PRESCOTT on the Sumatran algae. The specimens of the present materials have a deep constriction and an almost rectangular sinus, spines strong and robust and projected somewhat divergent but in some specimens almost horizontal and fairly variable in length, apex of semicell almost straight but sometimes slightly convex. Semicell in vertical view triangular, side slightly retuse but in some specimens almost straight, angles not tumid. Hab. 8–1, 9, 13, 17. Pl. 1, f. 6.

Staurastrum mucronatmu RALFS var. ***subtriangulare*** W. & G. S. WEST in West & Carter, Monogr. **5**, p. 12, pl. 130, f. 13, 1923.

Cells 26.5–30 μ long without spine, 26.5–35 μ broad without spine, and isthmus 5–6 μ broad. Hab. 5–2, 7–3, 17. Pl. 1, f. 13.

Staurastrum orbiculare RALFS in WEST, Monogr. **4**. p. 155, pl. 124, f. 10, 11, 1911.

Cells 38–40 μ long, 29–33 μ broad, and isthmus 11–12 μ broad. Hab. 1, 5–2, 17. Pl. 2, f. 6; Pl. 5, f. 13.

Staurastrum pingue TEILING in Bot. Notis. p. 66, f. 3–5, 1942; THOMASSON & TYLER, Nova Hedw. **21**, p. 293, f. 3–7, 1971.

Cell 31–53 μ long with processes, 66–75 μ broad with processes, and isthmus 7–9 μ broad. Cell moderately constricted and narrow-acuminate at the extremity; semicells campanulate in the lower part, apical angles produced into long 7–8 nodulates and almost horizontal or somewhat divergent process, tipped with 3 minute spines at the extremity. Hab. 1, 2–3, 5–2, 9, 13, 15, 17. Pl. 3, f. 8, 9; Pl. 5, f. 9; Pl. 6, f. 8.

Staurastrum polymorphum BRÉB. in WEST & CARTER, Monogr. **5**, p. 125, pl. 142, f. 24, pl. 143, f. 1–3, 1923; GRÖNBLAD & CROASDALE, Act. Bot. Fenn. **93**, p. 21, f. 127, 128, 1971.

Cell 31 μ long, 35 μ broad with processes, and isthmus 9 μ broad. Hab. 5–2.

Staurastrum polymorphum var. ***cinctum*** MESSIK. in Viertelj. naturf. Ges. Zurich **108**, p. 67, pl. 2, f. 39, 1963; GRÖNBLAD & CROASDALE, l.c. p. 22, pl. 9, f. 129, 130, 1971.

Cell 35 μ long, 39–40 μ broad with processes, and isthmus 8 μ broad. Hab. 17. Pl. 2, f. 7, 8; Pl. 5, f. 4, 5.

Staurastrum protectum W. & G. S. WEST var. ***rangoonense*** (SKUJA) SCOTT & PRESCOTT, Hydrobiol. **17**, p. 103, pl. 44, f. 1,2, 1961; HIRANO, Contr. Biol. Lab. Kyoto Univ. **23**, p. 152, pl. 9, f. 3, 1972.

Cell 25.5–28.5 μ long without spine, 31–36 μ broad without spine, and isthmus 8–9 μ broad. Hab. 5–2, 9, 13, 17. Pl. 3, f. 10; Pl. 5, f. 6, 7.

Staurastrum saltans JOSHUA in Journ. Linn. Soc. Bot. **21**, p. 641, pl. 23, f. 21, 1886; W. & G. S. WEST. Trans. Linn. Soc. Bot. **6**, p. 188, pl. 22, f. 13, 14, 1902.

Cell 39–40 μ long, 24 μ broad without processes, 70–71 μ broad with processes, and isthmus 9 μ broad. Hab. 15.

Staurastrum sexangulare (BULNH.) LUND. var. ***bidentatum*** GUTW. in Annales Royal Bot. Gard. Calcatta **6**, p. 224, pl. 16, f. 16, 1907.

Cell 44 μ long without processes, 88 μ long with processes, 35 μ broad without process, 88 μ broad with processes, and isthmus 11 μ broad. The present specimens coincide with the forms reported from Java and Burma, having those long and slender processes which are erected upward. The forms reported from the surrounding districts with the same species name are somewhat different from the present specimens in the shorter processes and the less number of nodulation. Hab. 15.

Staurastrum sexangulare var. ***crassum*** TURNER in GRÖNBLAD, Act. Soc. Faun. Flor. Fenn. **47**, p. 77, pl. 3, f. 119–120, 1920; HIRANO, Contr. Biol. Lab. Kyoto Univ. **23**, p. 153, pl. 9, f. 5, 1972.

Cell 90 μ long with processes, 96 μ broad with processes, and isthmus 21 μ broad. Hab. 15.

Staurastrum sexcostatum BRÉB. var. ***productum*** WEST in WEST & CARTER,

1.c. p. 148, pl. 150, f. 15, 1923; ROSA, Zvlastni otisk Casopis Narodniho Musea p. 5, f. 10, 1933.

Cell 42 μ long, 53.5 μ broad with process, and isthmus 11 μ broad. Cells 6-angular in vertical view; semicell furnished with a series of granules at the apex and having distinctly longer and much more nodulated processes than those of the British description given by WEST, four nodulations visible on each process, lacking a horizontal series of granules just above the isthmus. The granules at the apex of the semicell show a verrucae-like appearance in the British form given by WEST. In Thailand specimens granule does not show this tendency. The present specimens coincide with the figure of the form given by ROSA from Czechoslovakia. Hab. 15.

Staurastrum tetracerum RALFS in WEST & CARTER, 1.c. p. 118, pl. 149, f. 2, 3, 1923.

Cell 30 μ long, 30 μ broad and isthmus 5 μ broad. Hab. 5–2, 7–3, 8–1, 9, 15.

Staurastrum tortum (LAGERH. & NORDST.) W. & G. S. WEST in 1.c. **4**, p. 161, pl. 125, f. 9, 1911.

Cell 26.5–32 μ long, 20–26.5 μ broad, and isthmus 12–13 μ broad. The present specimens are larger than those of the Australian form, but both grow as a plankton. Semicell obtrapeziform, apex straight or convex, constriction of the cell is fairly deep in some specimens. Hab. 5–2, 7–3, 9, 13, 17. Pl. 2, f. 5.

Staurastrum unicorne TURNER in SCOTT & PRESCOTT, Record Amer.-Austral. Sci. Exped. Arnhem Land **3**, p.67, pl. 15, f. 16, 1958.

Cell 25 μ long, 22 μ broad without spine, and isthmus 5.5 μ broad. Hab. 5–2. Pl. 6, f. 3, 4.

Hyalotheca dissiliens (SM.) BRÉB. var. ***hians*** WOLLE in WEST & CARTER, Monogr. **5**, p. 234, pl. 162, f. 16–18, 1923.

Cells 14.5–15 μ long, 14–17.5 μ broad. Hab. 13, 17.

Hyalotheca indica TURNER in WEST & CARTER, 1.c. p. 237, pl. 162, f. 10, 1923.

Cell 12 μ long, 10 μ broad. Hab. 15.

Hyalotheca mucosa (MERT.) EHRENB. var. ***minor*** ROY & BISS. in WEST & CARTER, 1.c. p. 236, pl. 162, f. 5, 1923.

Cell 11 μ long, 9.7 μ broad. Hab. 1.

Sphaerozosma excavatum RALFS in WEST & CARTER, 1. c. p. 211, pl. 160, f. 1–3, 1923.

Cell 8 μ long, 6.5 μ broad, and isthmus 4 μ broad. Hab. 8–1, 9. Pl. 5, f. 8.

Sphaerozosma granulatus ROY & BISS. in WEST & CARTER, 1.c. p. 213, pl. 160, f. 6, 7, 1923.

Cell 11 μ long, 10 μ broad, and isthmus 4.5 μ broad. Hab. 1.

Desmidium aptogonum BRÉB. in WEST & CARTER, 1.c. p. 243, pl. 164, f.1–3, 1923.

Cell 17 μ long, 31 μ broad, and isthmus 22 μ broad. Hab. 9.

Spondylosium nitens (WALL.) ARCH. forma ***majus*** TURNER in SCOTT & PRESCOTT, Hydrobiol. **17**, p. 120, pl. 60, f. 9, 1961.

Cell 22 μ long, 35 μ broad, and isthmus 9.5 μ broad. Cells connected directly with the adjacent cell by the elevated apex of the semicell, lateral part of semicell horizontal or somewhat curved inward in a specimen, isthmus somewhat elongate so that sinus is well rounded at the extremity. Hab. 1. Pl. 2, f. 1; Pl. 4, f. 2.

Spondylosium nitens var. ***triangulare*** TURNER forma ***javanicum*** GUTW. in SCOTT & PRESCOTT, l.c. p. 121, pl. 60, f. 10, 1961.

Cells 26.5–28.5 μ long, 26.5–28.5 μ broad, and isthmus 6 μ broad. Hab. 1, 2–3, 5–2. Pl. 4, f. 1.

Spondylosium pulchrum BAIL. in GRÖNBLAD, Acta Soc. Sci. Fenn. n. ser. B, 2:6, p. 33, pl. 15, f. 316, 318, 1945.

Cell 17.6 μ long, 31 μ broad and isthmus 6.5 μ broad. Hab. 1. Pl. 1, f. 11.

Onychonema laeve NORDST. in WEST & CARTER, Monogr. 5, p. 218, pl. 160, f. 15, 16, 1923.

Cells 20–24 μ long, 26.5–35 μ broad, and isthmus 6.5 μ broad. There are two different forms in the present specimens: the one coincides well with the typical form and the other resembles var. *sumatranum* described by SCOTT & PRESCOTT. The retuseness of the apex of semicell is rather broader than those of the Sumatran form and also the shape of semicell is somewhat different. Hab. 5–2, 15. Pl. 1, f. 8, 9; Pl. 6, f. 2.

Streptonema trilobatum WALL. in SCOTT & PRESCOTT, Hydrobiol. **17**, p. 125, pl. 63, f. 10–16, 1961.

Cells 29–35 μ long, 46–48.5 μ broad, and isthmus 13–15 μ broad. Hab. 5–2, 15. Pl. 1, f. 12; Pl. 6, f. 1.

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Plate 1

1. *Xanthidium hastiferum* TURNER var. *javanicum* (NORDST.) TURNER
2. *Closterium sinense* LÜTKEM. var. *minus* HIRANO, var. nov.
3. *Cosmarium cuneatum* JOSHUA
4,5. *Arthrodesmus curvatus* TURNER var. *kalimanthanum* SCOTT & PRESCOTT
6. *Staurastrum megacanthum* LUND. var. *orientale* SCOTT & PRESCOTT
7. *Arthrodesmus convergens* EHRENB. var. *curtus* TURNER
8,9. *Onychonema laeve* NORDST.
10. *Cosmarium subtriordinatum* W. & G. S. WEST
11. *Spondylosium pulchrum* BAIL.
12. *Streptonema trilobatum* WALL.
13. *Staurastrum mucronatum* RALFS var. *subtriangulare* W. & G. S. WEST

Plate 1

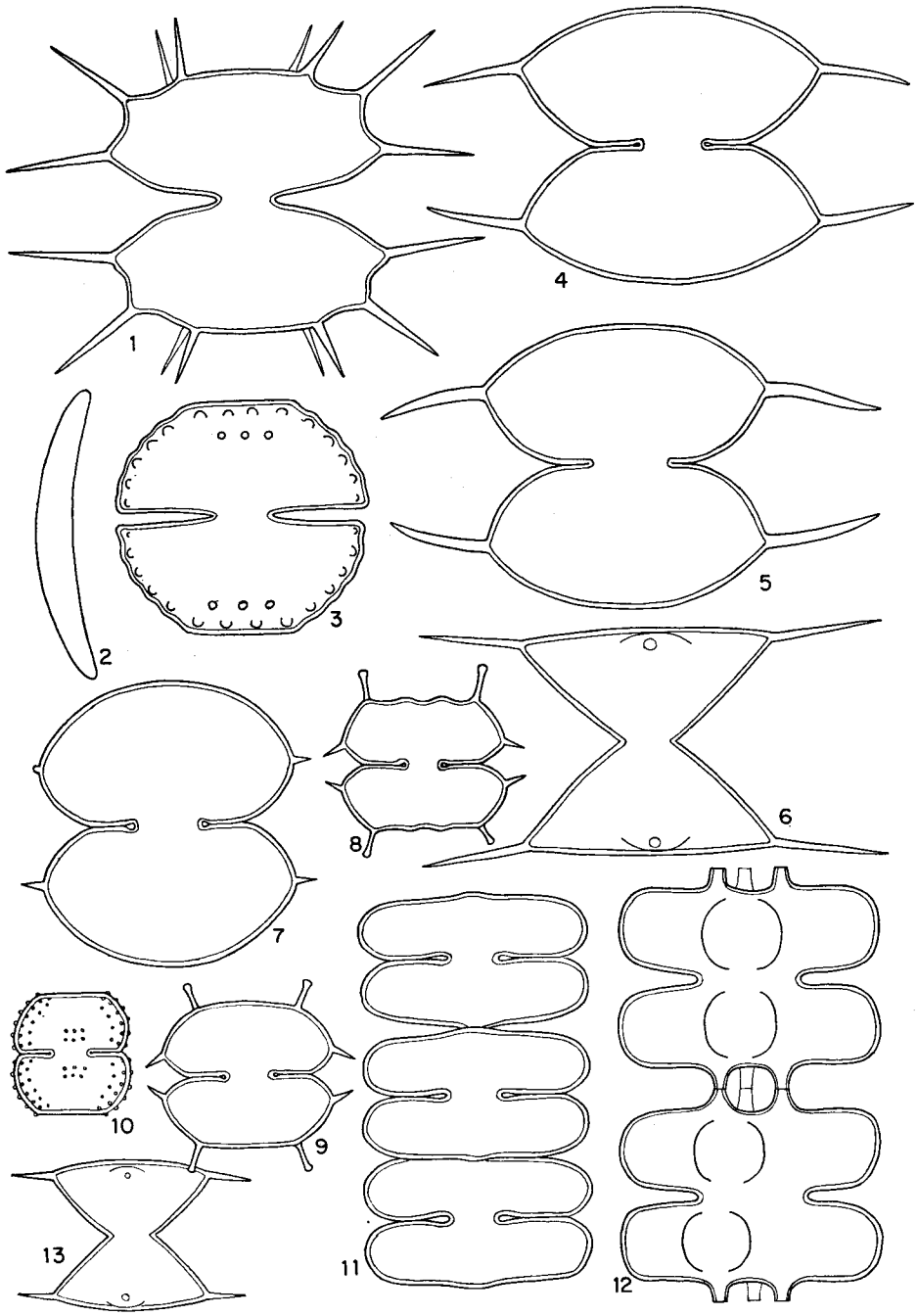

Plate 2

1. *Spondylosium nitens* (WALL.) ARCH. forma *majus* TURNER
2. *Arthrodesmus curvatus* TURNER
3. *Cosmarium trachypleurum* LUND. var. *nordstedtii* GUTW.
4. *Cosmarium tijibenongense* GUTW. forma *minus* G. S. WEST
5. *Staurastrum tortum* (LAGERH. & NORDST.) W. & G. S. WEST
6. *Staurastrum orbiculare* RALFS
7,8. *Staurastrum polymorphum* BRÉB. var. *cinctum* MESSIK.
9. *Staurastrum ambiguum* TURNER
10,11. *Staurastrum leptodermum* LUND. var. *ikapoae* (SCHMIDLE) W. & G. S. WEST
12. *Cosmarium lundellii* DELP. forma *crassangulatum* SCOTT & PRESCOTT
13. *Cosmarium alpestre* ROY & BISS.

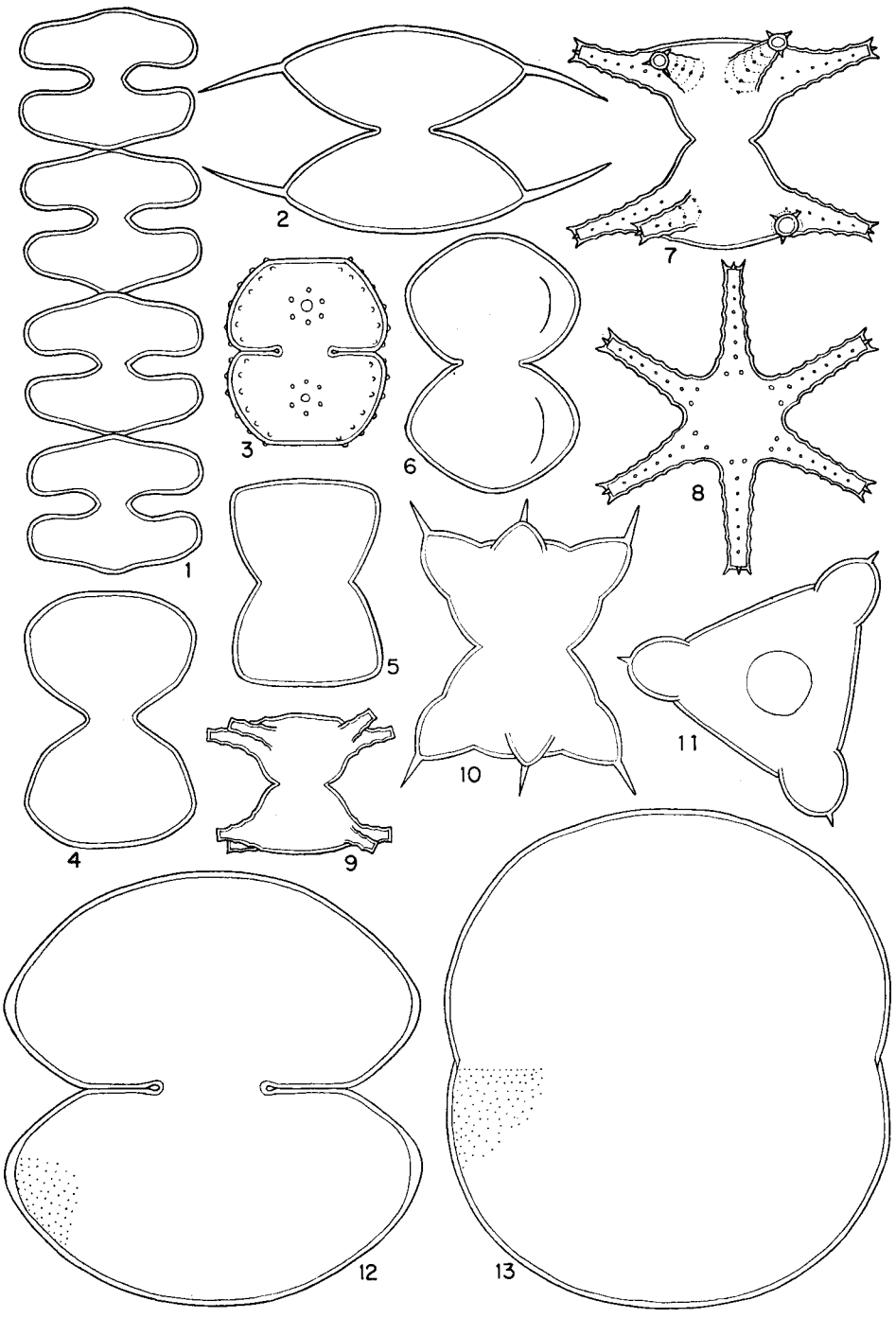
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Plate 3

1,2. *Staurastrum limneticum* SCHMIDLE var. *burmense* W. & G. S. WEST
3,4. *Staurastrum javanicum* (NORDST.) TURNER var. *apiculiferum* (TURNER) KRIEGER
5. *Staurastrum longebrachiatum* (BORGE) GUTW.
6,7. *Staurastrum gracile* RALFS var. *coronulatum* BOLDT
8,9. *Staurastrum pingue* TEILING
10. *Staurastrum protectum* W. & G. S. WEST var. *rangoonense* (SKUJA) SCOTT & PRESCOTT
11. *Staurastrum excavatum* G. S. WEST

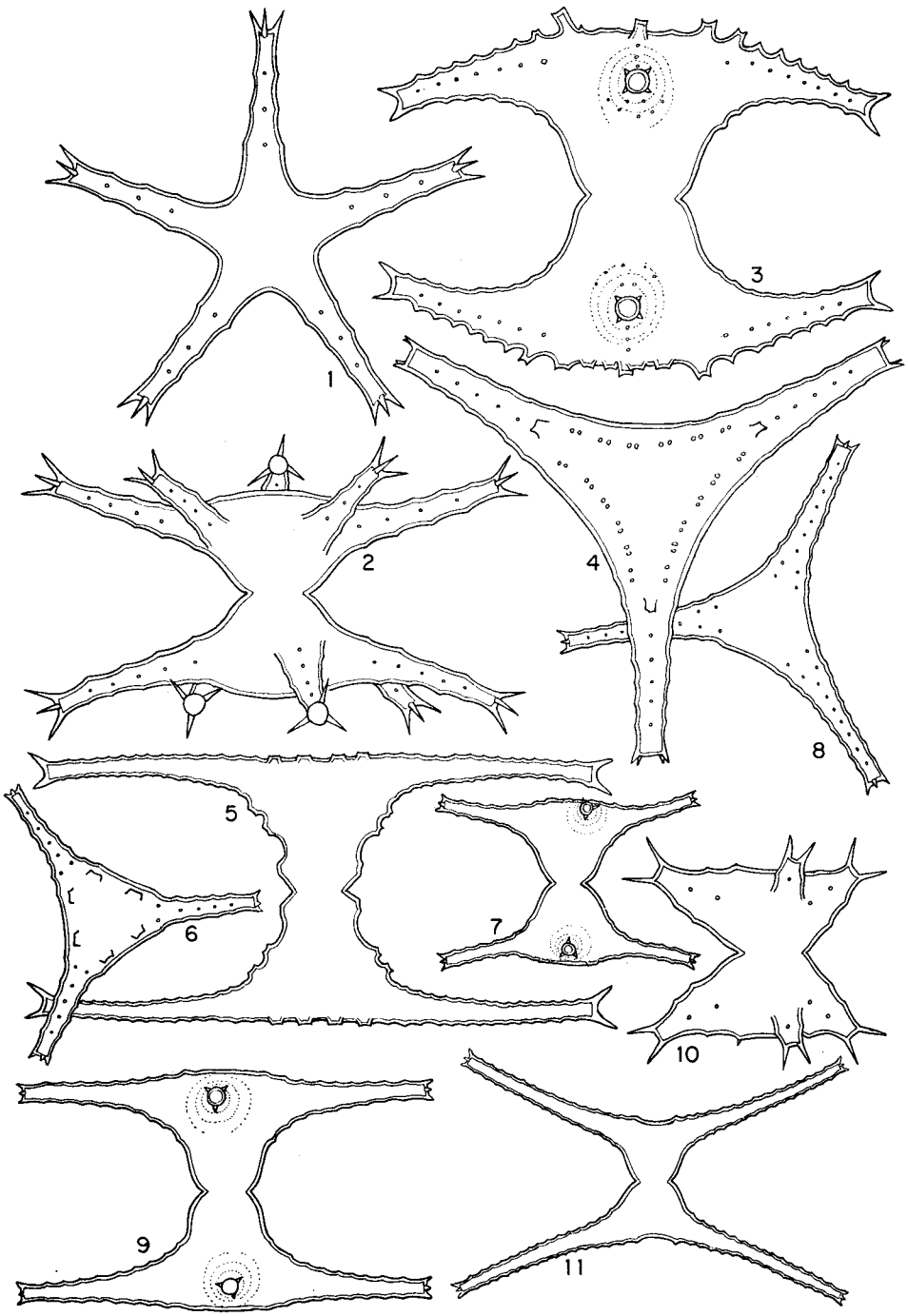
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Plate 4

1. *Spondylosium nitens* (WALL.) ARCH. var. *triangulare* TURNER forma *javanicum* GUTW.
2. *Spondylosium nitens* (WALL.) ARCH. forma *majus* TURNER
3. *Pediastrum duplex* MEYEN var. *gracillimum* W. & G. S. WEST
4. *Pediastrum duplex* var. *cohaerens* BOHLIN
5. *Tetraedron regulare* KG.
6. *Trachelomonas armata* (EHRENB.) STEIN var. *steinii* DEFL.
7. *Trachelomonas superba* DELF.
8. *Trachelomonas pulcherrima* PLAYFAIR
9. *Trachelomonas hispida* (PERTY) DEFL. var. *duplex* DEFL.
10. *Nephrocytium lunatum* W. WEST
11. *Ophiocytium cochleare* A. BR.
12. *Centritractus belonophorus* (SCHMIDLE) LEMM.
13. *Actinastrum hantzschii* LAGERH. var. *fluviatile* SCHRÖDER

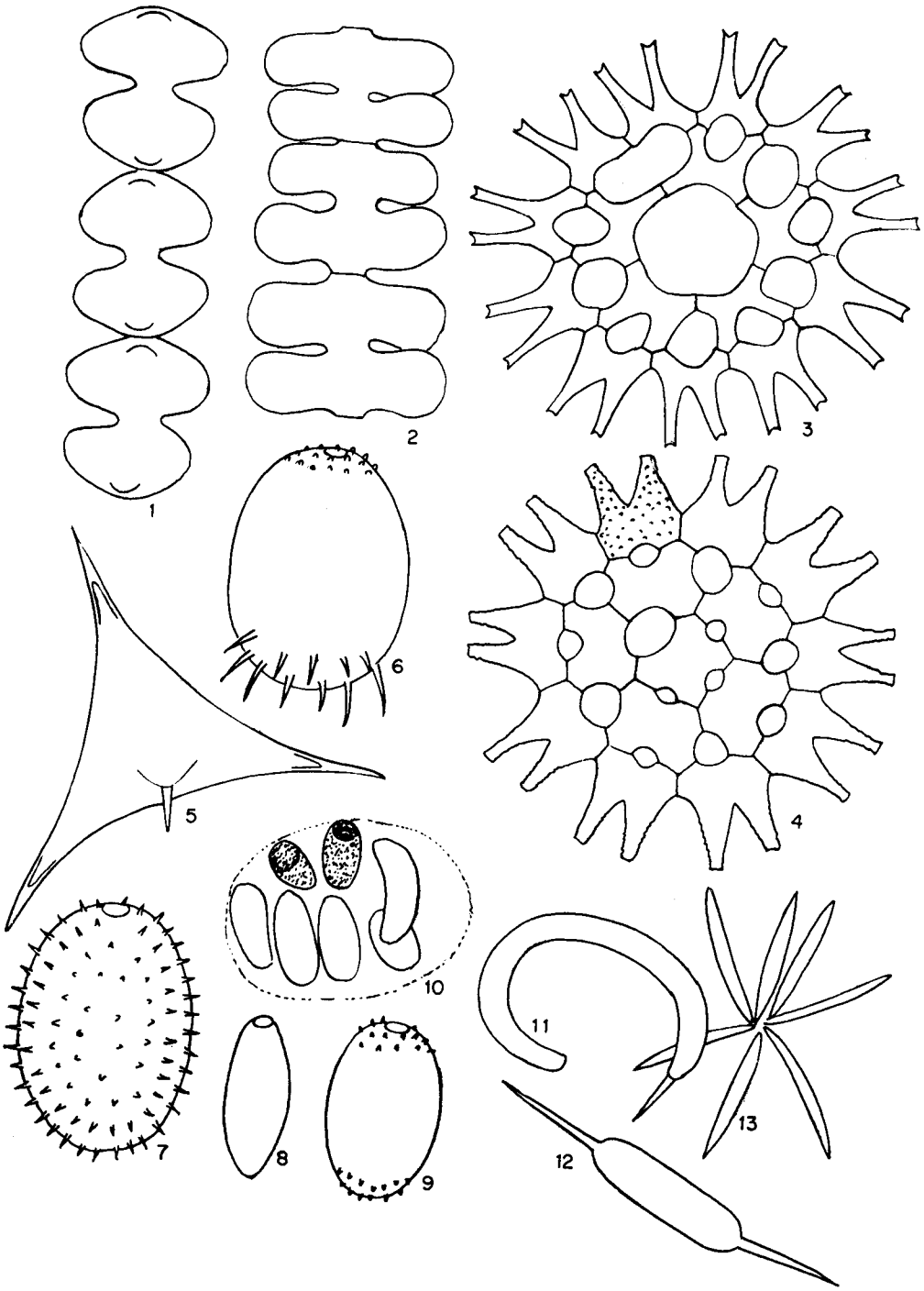
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Plate 5

1. *Staurastrum leptodermum* LUND. var. *ikapoae* (SCHMIDLE) W. & G. S. WEST
2,3. *Staurastrum gracile* RALFS var. *coronulatum* BOLDT
4,5. *Staurastrum polymorphum* BRÉB. var. *cinctum* MESSIK.
6,7. *Staurastrum protectum* W. & G. S. WEST var. *rangoonense* (SKUJA) SCOTT & PRESCOTT
8. *Sphaerozosma excavatum* RALFS
9. *Staurastrum pingue* TEILING
10. *Staurastrum acanthastrum* W. & G. S. WEST
11. *Staurastrum excavatum* G. S. WEST
12. *Arthrodesmus curvatus* TURNER
13. *Staurastrum orbiculare* RALFS
14. *Cosmarium trachypleurum* LUND. var. *nordstedtii* GUTW.
15. *Cosmarium contractum* KIRCHN.
16. *Cosmarium impressulum* ELFV.
17. *Cosmarium pseudarctoum* NODRST.

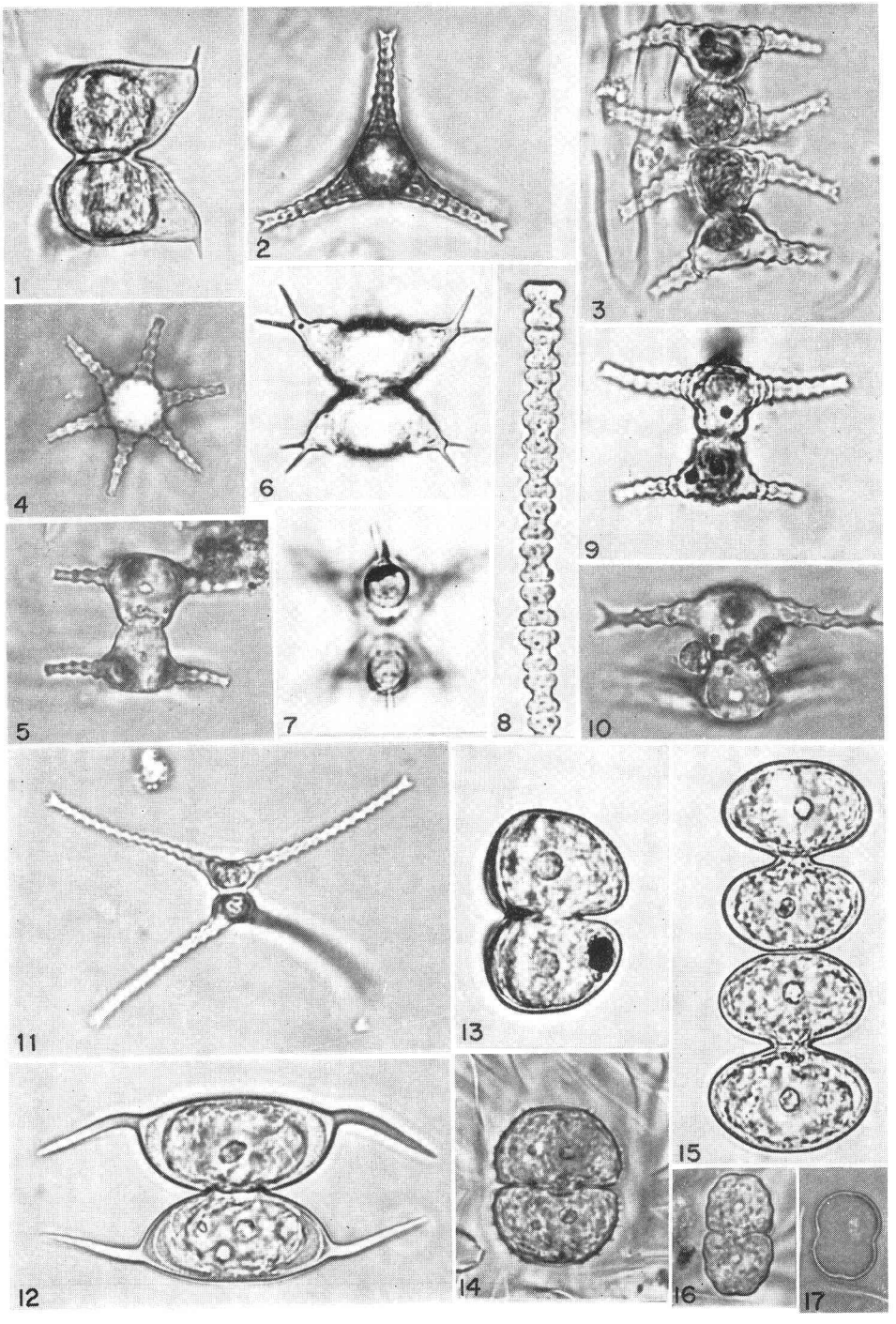
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Plate 6

1. *Streptonema trilobatum* WALL.
2. *Onychonema laeve* NORDST.
3,4. *Staurastrum unicorne* TURNER
5. *Arthrodesmus convergens* EHRENB. var. curtus TURNER
6. *Staurastrum javanicum* (NORDST.) TURNER var. *apiculiferum* (TURNER) KRIEGER
7. *Staurastrum longebrachiatum* (BORGE) GUTW. var. *pseudanchora* KRIEGER
8. *Staurastrum pingue* TEILING
9. *Xanthidium hastiferum* TURNER var. *javanicum* (NORDST.) TURNER

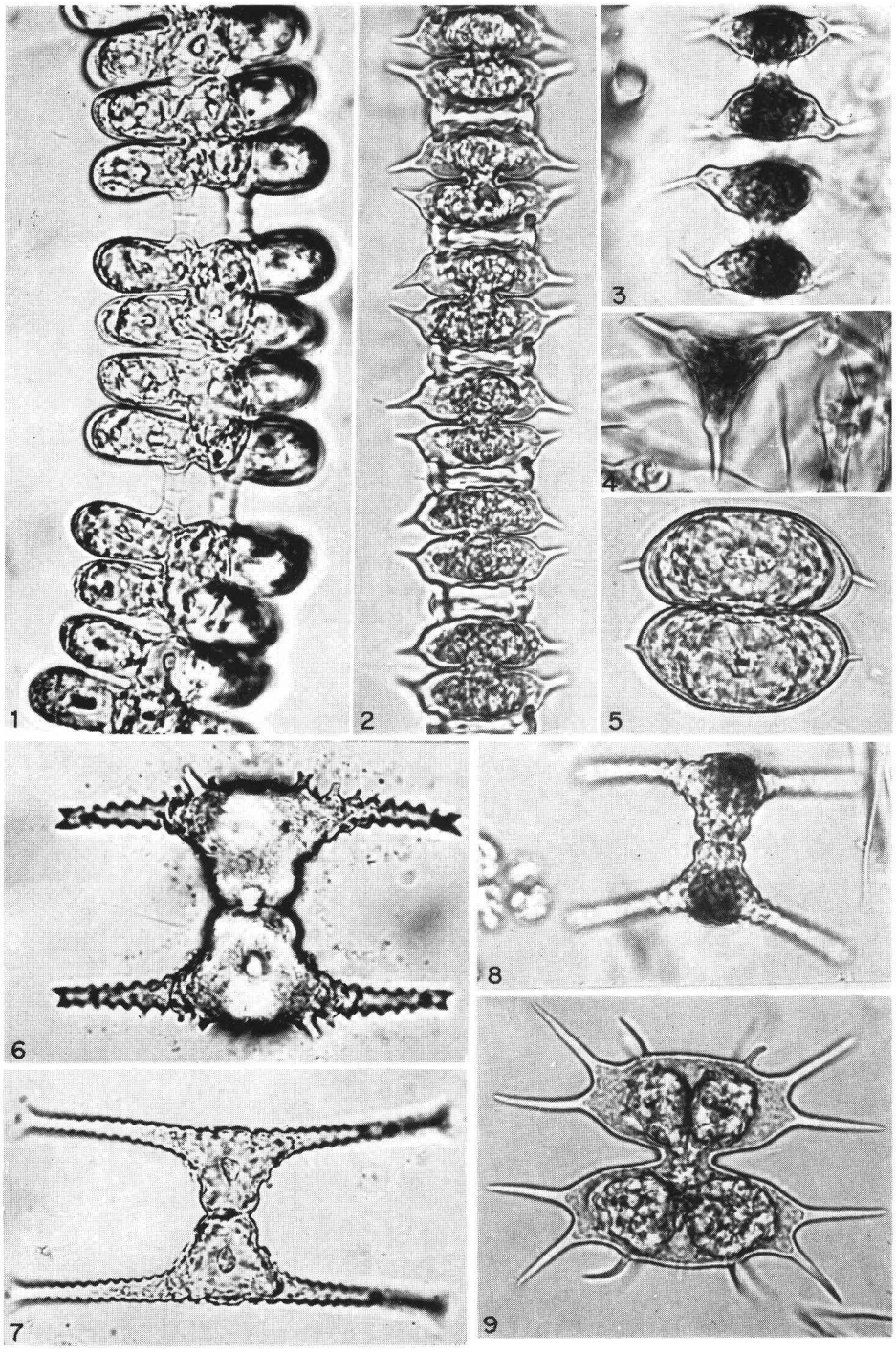
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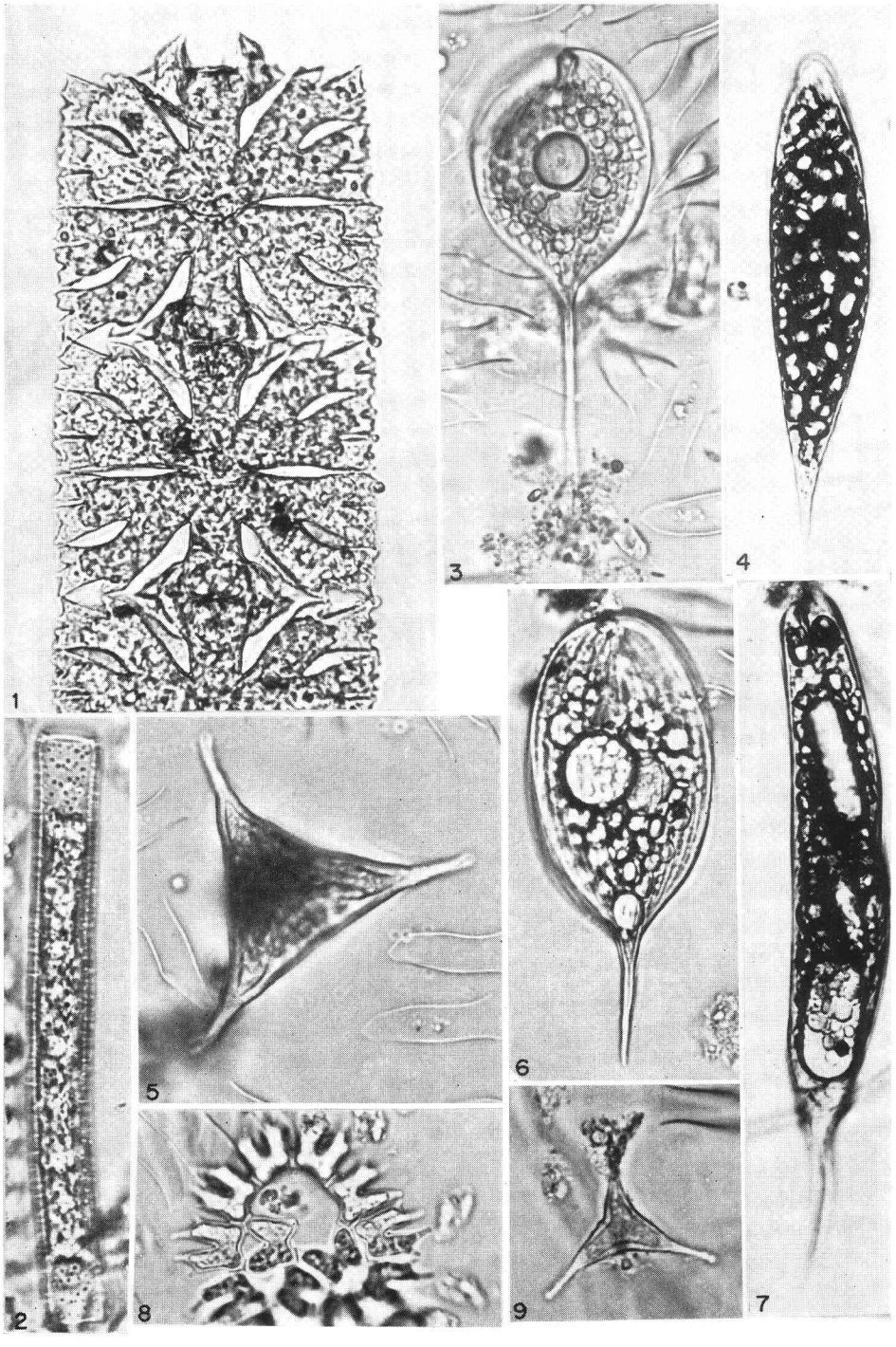
Plate 7

1. *Micrasterias foliacea* BAIL.
2. *Gonatozygon monotaenium* DeBARY
3. *Phacus longicauda* (EHRENB.) DUJ.
4. *Euglena proxima* DANG.
5. *Tetraedron regulare* KG.
6. *Phacus ranula* POCHMANN
7. *Euglena charkowiensis* SWIR.
8. *Pediastrum biradiatum* MEYEN var. *longecornutum* GUTW.
9. *Tetraedron trigonum* (NÄG.) HANSG. var. *gracile* (REINSCH) DeTONI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